

# **Update: Clean Air Mercury Rule (CAMR)**

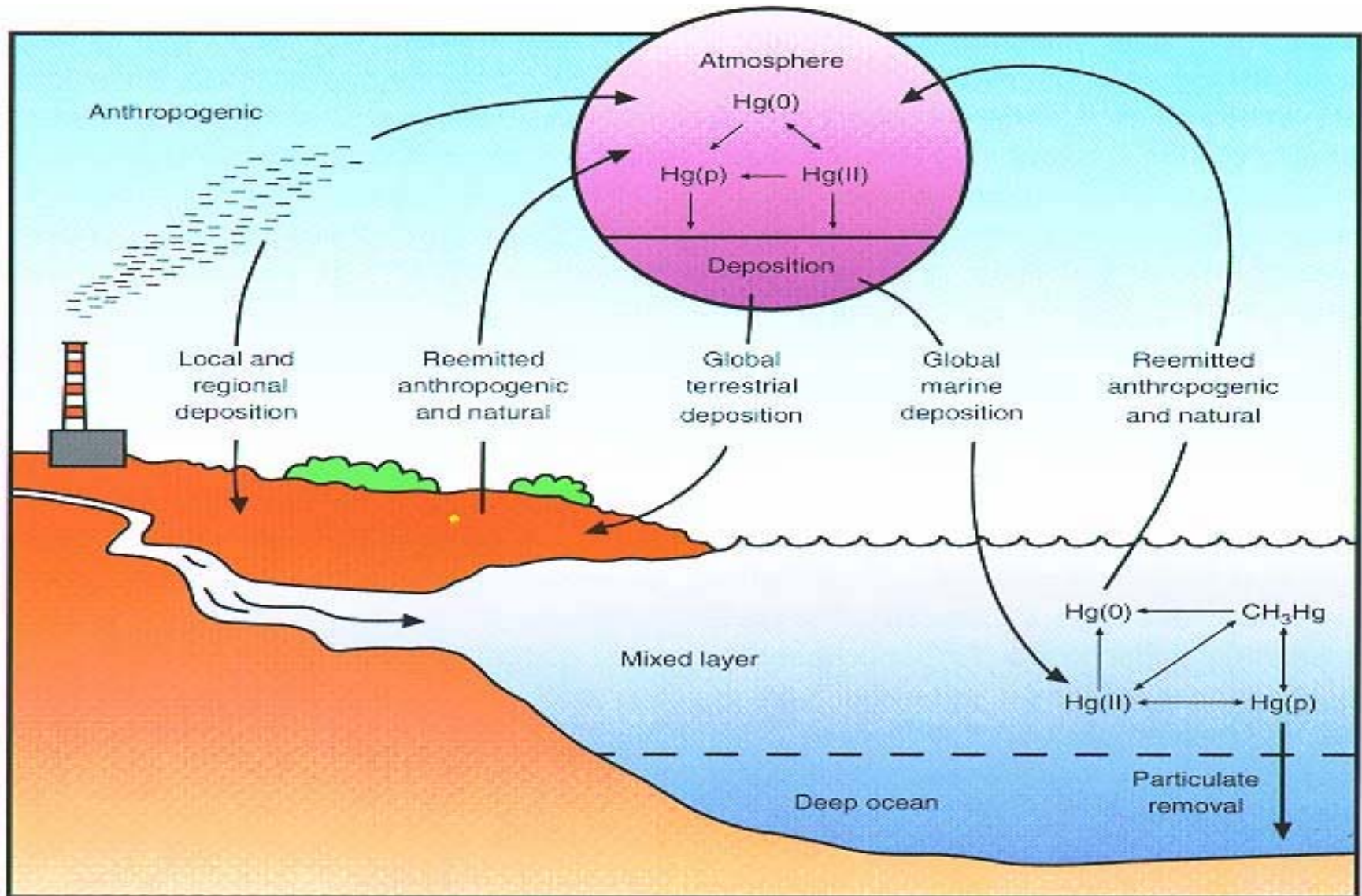


**Presentation to Clean Air Act Advisory Committee**

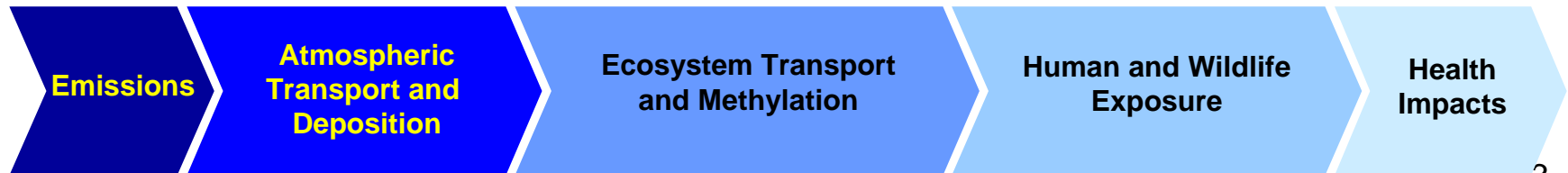
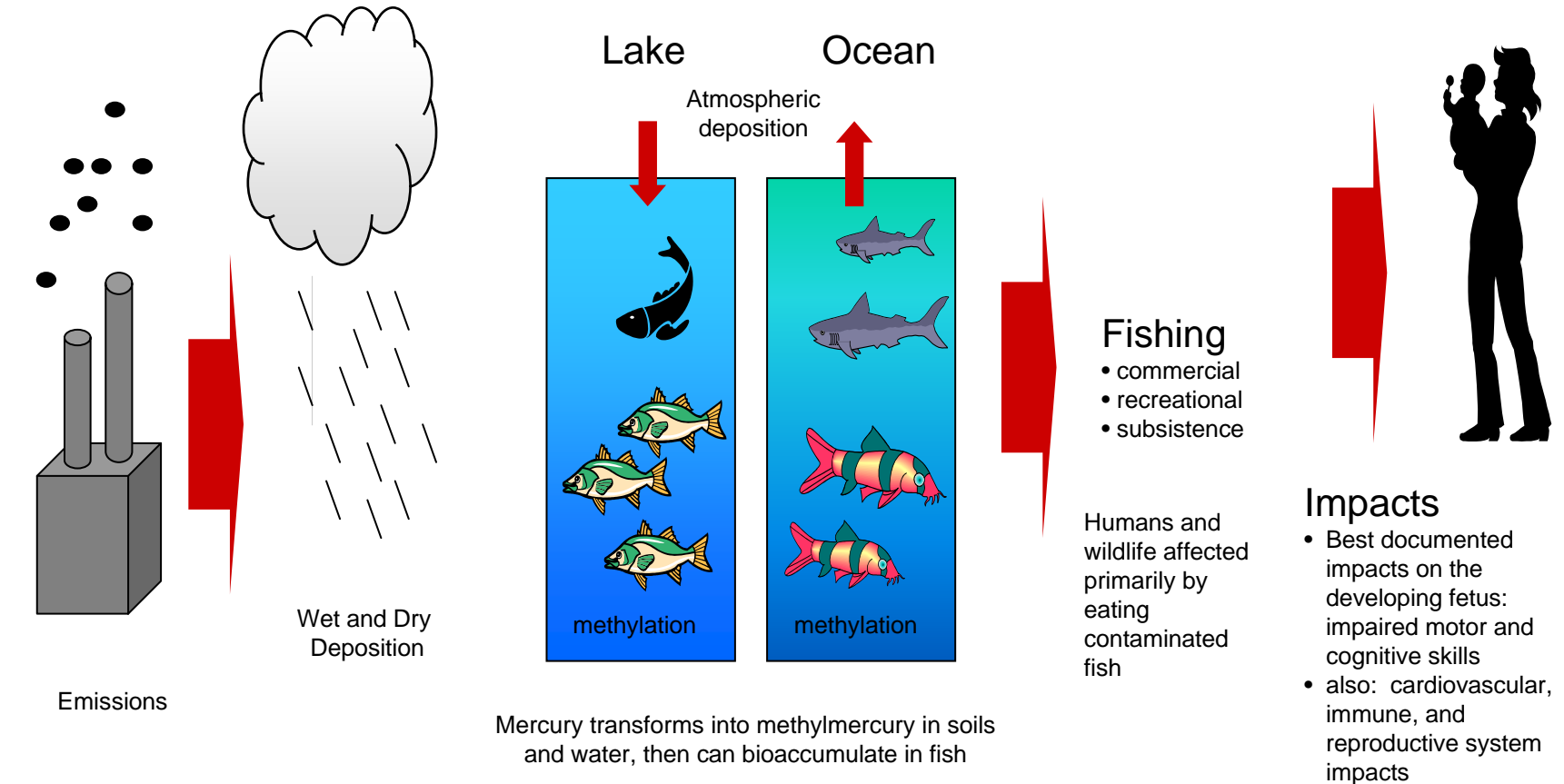
**Sally L. Shaver, Director  
Emission Standards Division  
Office of Air and Radiation**

**June 24, 2004**

# Mercury Cycling Pathways

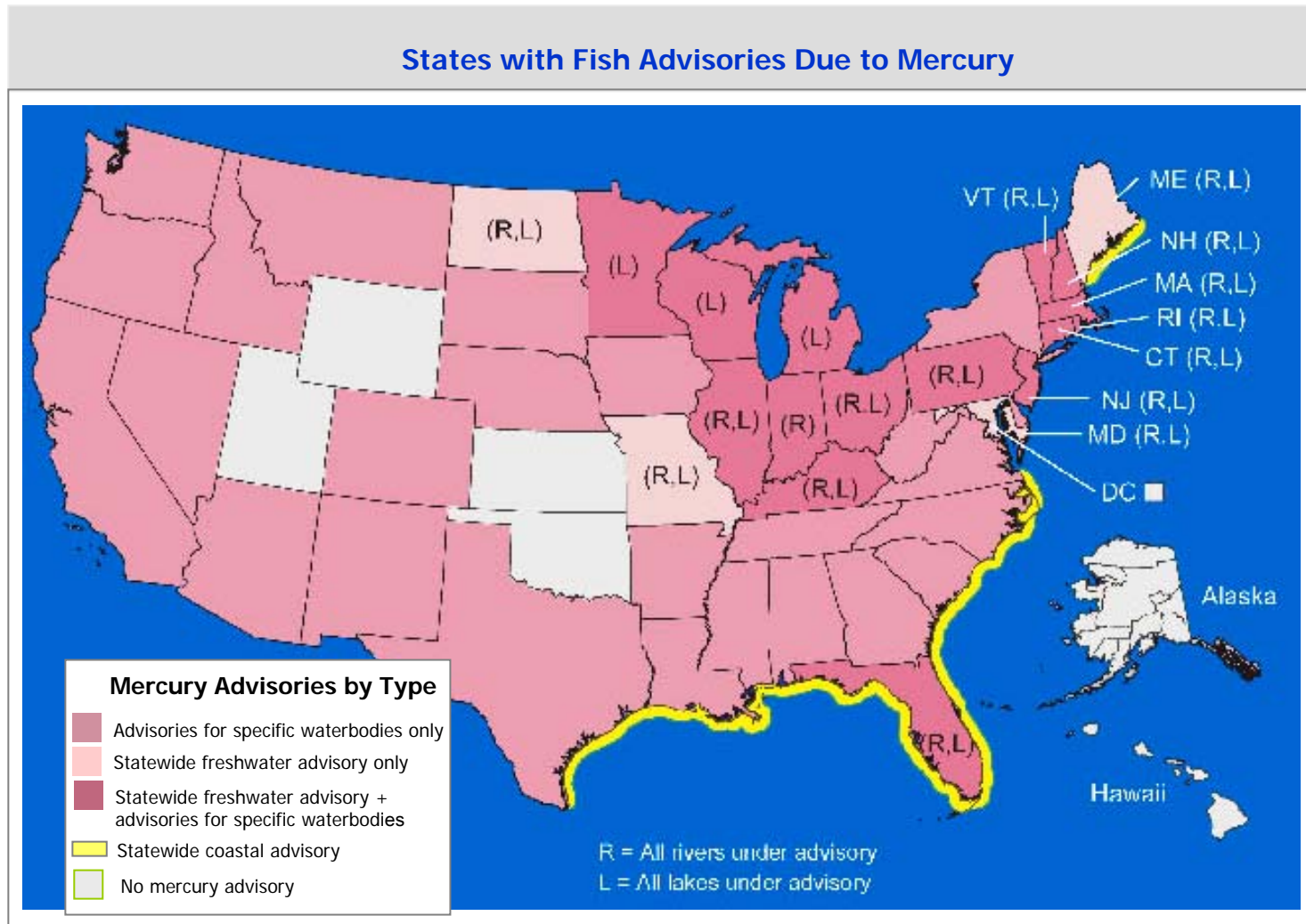


# Mercury Emissions Contribute to Human Exposure to Mercury



# Mercury Contamination in Fish

- **Currently 44 states have issue fish consumption advisories for some or all of their waters due to contamination from mercury.\***

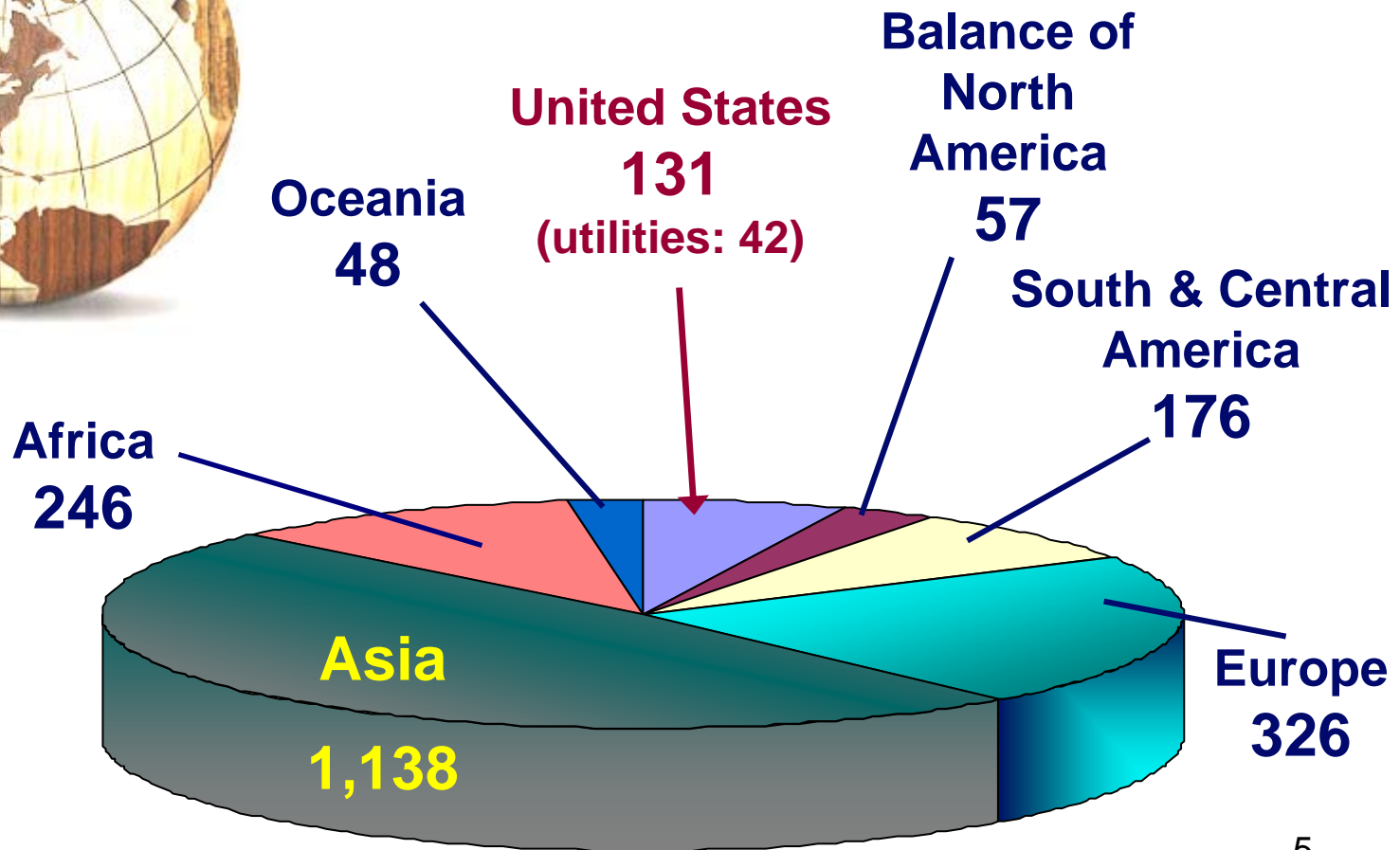


\*Note: For more information about the relationship between fish advisories and human exposure to mercury, see the EPA Report "America's Children and the Environment: Measures of Contaminants, Body Burdens, and Illnesses" available at <http://yosemite.epa.gov/o/chp/ochpweb.nsf/content/publications.htm>

# Mercury Global Emissions - Anthropogenic Emissions by Continent



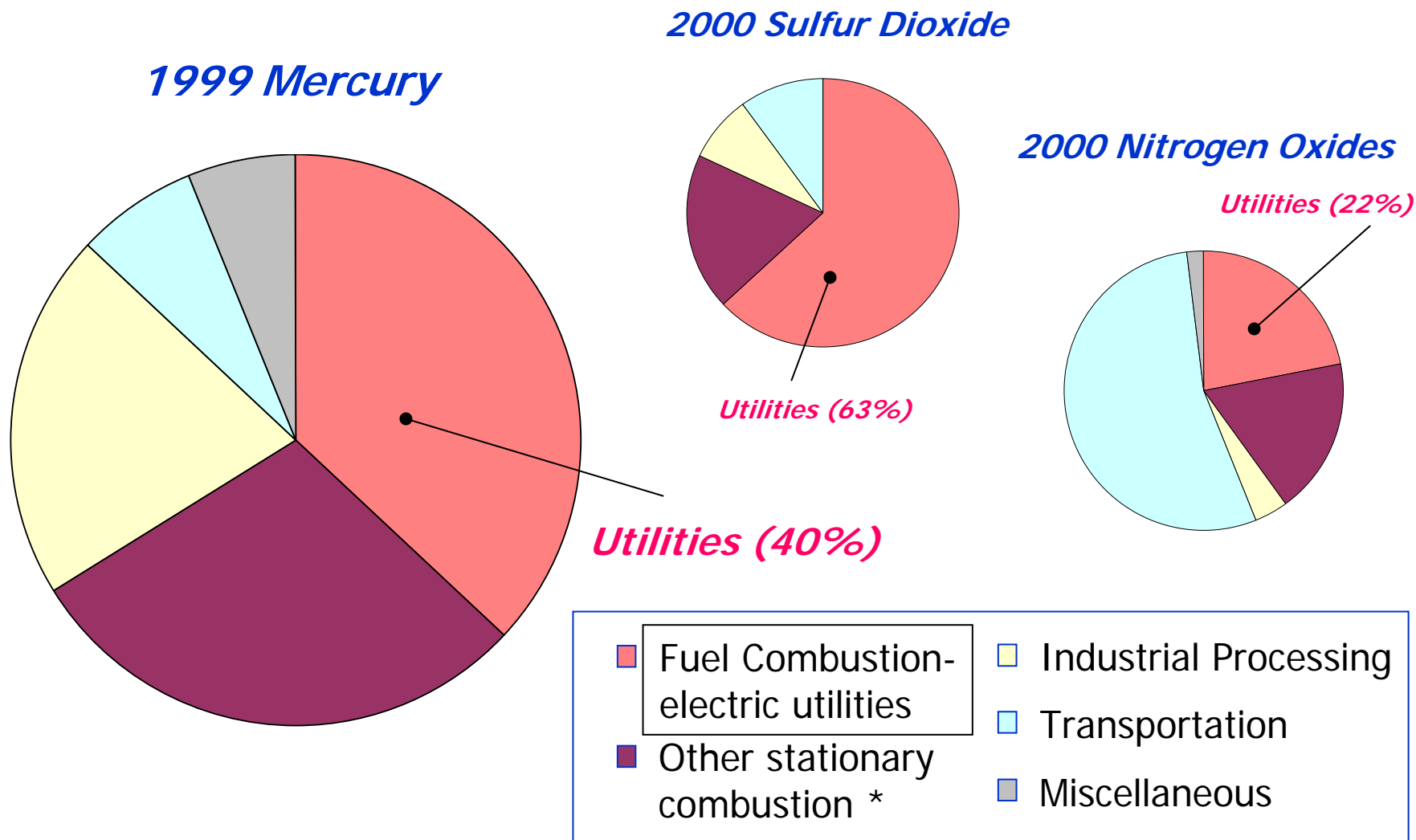
*Global total: 2,122 Mg/y*



(Adapted from EPRI, 2004)<sup>5</sup>



# Power Generation Is a Major Source of Emissions



# Pollutant Reduction for Coal-fired Utilities

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- Emissions reductions possible through:
  - End-of-pipe control technologies
  - Advanced power generation technologies
  - Power plant efficiency improvements
  - Fuel switching
- Focus on emissions control technologies that provide emission reduction co-benefits
  - Potential for increased emission control at overall reduced cost
  - Potential for increased flexibility

# NO<sub>x</sub> Control Technologies and Co-benefits

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- Low NO<sub>x</sub> burners (LNBs)
  - Impact on mercury reduction not well quantified.
- Selective non-catalytic reduction (SNCR)
  - Limited impact on mercury reduction.
- Selective catalytic reduction (SCR)
  - SCR converts Hg<sup>(0)</sup> – Hg<sup>(++)</sup>
  - Some reduction could improve for bituminous coals with wet scrubber.



# SO<sub>2</sub> Control Technologies and Co-benefits

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- Wet scrubbers
  - Good mercury removal of the water-soluble forms (e.g., Hg<sup>(++)</sup>, etc.).
- Dry scrubbers
  - Data more variable depending on the PM removal technology used.

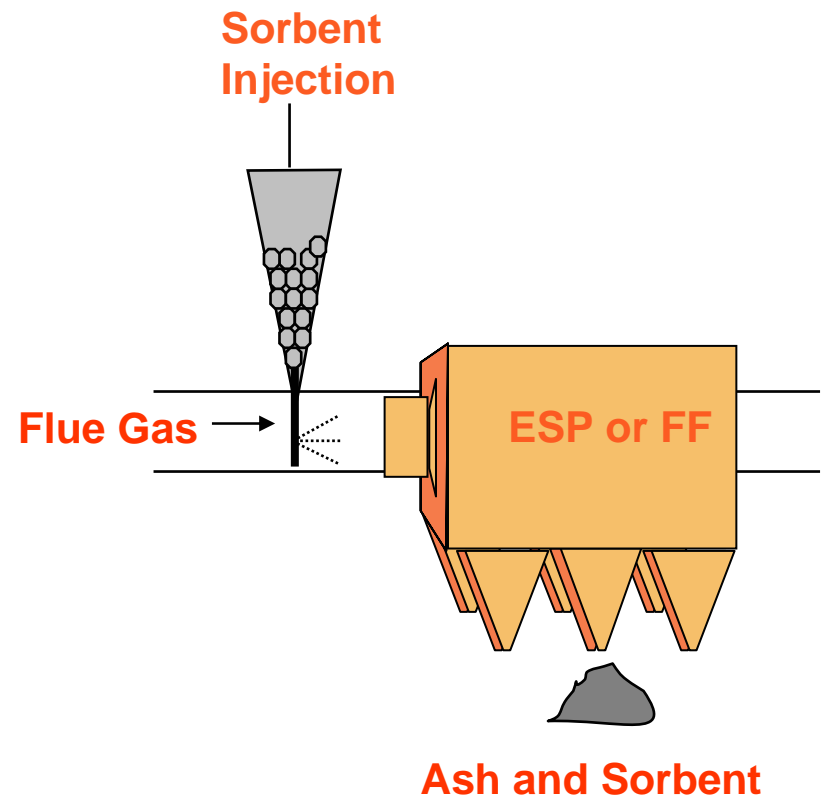
# PM Control Technologies and Co-benefits

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- High variability of mercury test data results.
- Mercury removal enhanced when PM controls are used with NO<sub>x</sub> and SO<sub>2</sub> controls.
- Electrostatic precipitators (ESPs)
  - Installed on 72% of U.S. coal-fired boilers
- Baghouses (fabric filters)
  - Installed on 14% of U.S. coal-fired boilers

# Beyond Co-benefits -- Sorbent Injection

- The extent of capture depends on:
  - Sorbent characteristics (particle size distribution, porosity, capacity at different gas temperatures)
  - Residence time in the flue gas
  - Type of PM control (FF vs. ESP)
  - Concentrations of  $\text{SO}_3$  and other contaminants



# Activated Carbon Injection (ACI)

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- ACI successfully used to reduce mercury emissions from waste-to-energy facilities. Effort underway to transfer to coal-fired power plants.
- Not currently installed at any power plant, but short-term testing suggests it may eventually be able to achieve up to 90% control for all coal types.

*Activated carbon storage and feed system*



# Recent Power Plant Activated Carbon Injection Demonstration Projects

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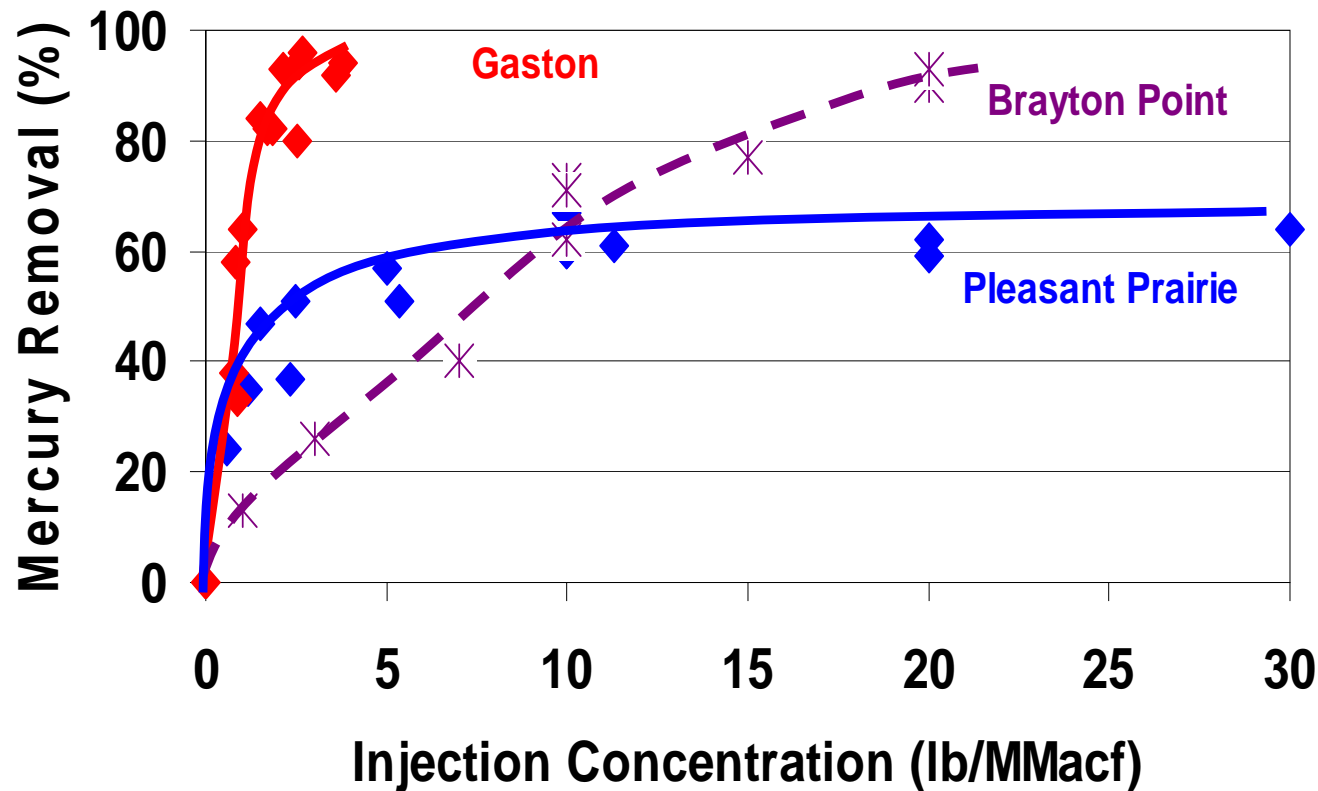
- **Alabama Power E.C. Gaston:** unit 3, 135-MW equivalent, low-sulfur eastern bituminous coals
  - Longest continuous short-term test run – 9 days
  - Long-term test (~1 year) underway
- **WEPCO Pleasant Prairie:** unit 2, 150-MW equivalent, Powder River Basin, subbituminous coal
  - Longest continuous short-term test run – 5 days
- **PG&E Brayton Point:** unit 1, 245-MW, low-sulfur bituminous coal
- **PG&E Salem Harbor:** 85-MW, low-sulfur bituminous coal



Alabama Power E.C. Gaston Plant

# Mercury Removal Trends with ACI

Results from Pilot Studies at 3 Coal-Fired Plants



Source: ADA Environmental Solutions (2003)

# So...

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- We need more NO<sub>x</sub>, SO<sub>2</sub>, and PM reductions for fine particulate (PM<sub>2.5</sub>) and 8-hr ozone attainment
- Current control technologies for NO<sub>x</sub>, SO<sub>2</sub>, and PM are capable of significantly reducing power plant mercury emissions
- Mercury-specific control technologies are not ready for full-scale commercial deployment
- And...settlement agreement says we must propose mercury rule by 12/15/2003 and promulgate by 12/15/04...now 03/15/05



# EPA Proposes to Reduce Utility Emissions through Current CAA Authorities...

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- **Clean Air Interstate Rule (CAIR)** to address the contribution of transported  $\text{SO}_2/\text{NO}_x$  emissions to ozone (smog) and fine particle ( $\text{PM}_{2.5}$ ) nonattainment problems in the Eastern U.S.
- **Clean Air Mercury Rule (CAMR)** to address emissions of mercury

# Clean Air Mercury Rule – Options for Controlling Mercury from Coal-Fired Power Plants

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# Proposed Alternatives to Reduce Mercury Emissions from the Power Sector

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- Proposed section 112 MACT requirements for coal-fired generation units
  - Reduces mercury emissions from 48 to approximately 34 tons by 2008 with controls based on coal type.
- Proposed cap-and-trade approach to address mercury from coal-fired generation units under section 111
  - Revises December 2000 determination to use section 112 MACT requirements.
  - Commits to phased-in caps: first cap at co-benefits level in 2010; second cap at 15 tons in 2018.
  - Caps annual mercury emissions at 15 tons in 2018 and after.
- Also, discusses cap-and-trade approach under section 112(n)(1)(A)

# Proposed Section 112 MACT

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- Existing sources
  - Six subcategories
  - Limits are based on the average of the top 12% of sources in each subcategory
  - Accounted for variability
  - Emission standards applicable to each source
  - No trading
- New sources
  - Six subcategories
  - Limits are based on the best performing similar source in each subcategory
  - Accounted for variability
  - Emission standards applicable to each source
  - No trading

# Proposed Existing Source MACT Limits

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Subcategory	Hg (lb/TBtu) <sup>1</sup>	Hg (10 <sup>-6</sup> lb/MWh) <sup>1</sup>
Bituminous-fired	2.0	21
Subbituminous-fired	5.8	61
Lignite-fired	9.2	98
IGCC	19.0	200
Coal refuse-fired	0.38	4.1

<sup>1</sup> – Based on a 12-month rolling average

Subcategory	Ni (lb/TBtu) <sup>2</sup>	Ni (lb/MWh) <sup>2</sup>
Oil-fired	210	0.002

<sup>2</sup> – Based on a not-to-exceed annual limit

**NOTE:** Output-based standards are referenced to a baseline efficiency (32% for existing units).

# Proposed New Source MACT Limits

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Subcategory	Hg (10 <sup>-6</sup> lb/MWh) <sup>1</sup>
Bituminous-fired	6.0
Subbituminous-fired	20
Lignite-fired	62
IGCC	20 <sup>3</sup>
Coal refuse-fired	1.1

<sup>1</sup> – Based on a 12-month rolling average

<sup>3</sup> – Based on a 90% reduction for beyond-the-floor control

Subcategory	Ni (lb/MWh) <sup>2</sup>
Oil-Fired	0.0008

<sup>2</sup> – Based on a not-to-exceed annual limit

**NOTE:** Output-based standards are referenced to a baseline efficiency (35% for new units).

# Proposed Section 112 Monitoring and Compliance Requirements

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- Mercury testing and monitoring requirements
  - Three options for mercury monitoring
    - Continuous Emission Monitors (CEM)
    - Carbon Absorption Tube
    - Manual Stack Test
- Allows for emissions averaging across facility for mercury



# Proposed Section 111 Alternative

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- January 2004 proposal:
  - New sources
    - Federal rule – 111(b)
    - Includes emission limits for mercury (coal-fired) and nickel (oil-fired)
      - Limits same as new-source MACT
  - Existing sources
    - Federal Guidelines for State Implementation Plans – 111(d)
      - Sets mercury emission rates for coal-fired utility units under a cap-and-trade program administered by States
        - » Phase 1: 2010 (solicit comment on co-benefits-based cap level)
        - » Phase 2: 2018 Capped at 15 tons
      - Sets a limit for nickel emissions from oil-fired units

# Proposed Section 111 Alternative – cont.

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- March 2004 supplemental proposal:
  - Establishes model trading program
  - Provides model mercury trading rule
  - Allocates State budget allocations
  - State requirements
    - Each State must submit a plan that demonstrates it will meet its assigned statewide mercury emissions budget
      - States may join the trading program by adopting or referencing the model trading rule in State regulations; or, adopting regulations that mirror the necessary components of the model trading rule
      - States can choose not to join the Federal trading program and meet their budget through intra-state trading or no trading
      - States can also choose to implement more stringent mercury emissions requirements
  - Monitoring requirements

# Proposed Section 111 Hg Monitoring Requirements

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- Requires continuous monitoring of mercury sufficient to support the trading program
- A comprehensive QA/QC program ensures the adequacy and completeness of emissions data
- Regulated sources would have the flexibility of using alternative monitoring approaches as long as such approaches meet the performance requirements in the rule

# Benefits of Section 111 Alternative

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- Would reduce nationwide mercury emissions by 33 tons (69 percent) from today's levels when fully implemented after 2018.
- Potential for earlier and greater reductions than proposed MACT alternative.
- Complements the CAIR, creating an integrated multipollutant approach to controlling emissions from power plants.

# Proposed Section 112 Trading Alternative

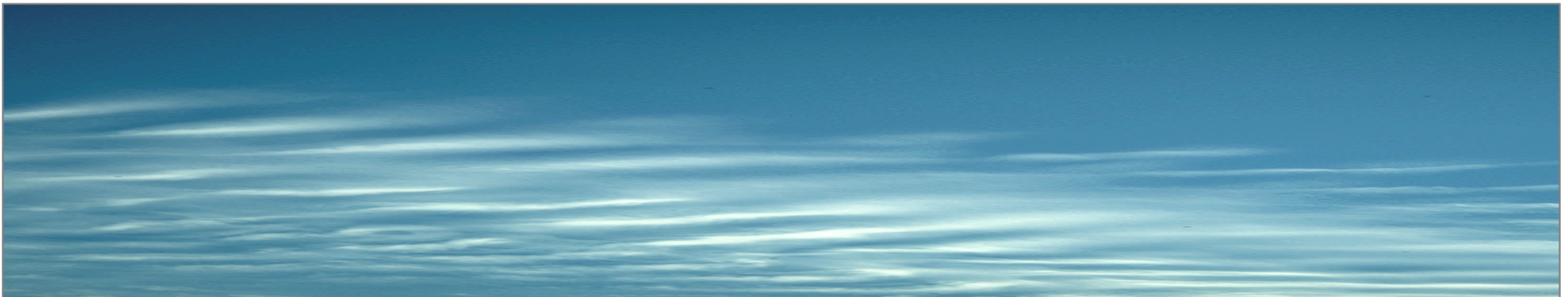
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- EPA has taken comment on a proposal to promulgate, under section 112(n)(1)(A), a cap-and-trade program for mercury from coal-fired utility units
  - Trading program would be Federally implemented with the EPA, instead of States, serving as the permitting authority

# Perspective on Approach

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- Administration prefers Clear Skies
  - Provides substantial health and environmental benefits with certainty, less complexity, and reasonable economic impacts.
- However, the Clean Air Interstate and Mercury Rules will:
  - Help cities and States in the East meet new, more stringent national ambient air quality standards for ozone and fine particles.
  - Provide substantial health, welfare, and environmental benefits.
  - Will maintain both fuel diversity and low electricity prices.
  - Provide benefits at a very reasonable cost.
  - Address major power sector emissions in an integrated manner.







*Further Information:*

*[www.epa.gov/interstateairquality](http://www.epa.gov/interstateairquality)*

*[www.epa.gov/mercury](http://www.epa.gov/mercury)*